

ANNUAL REPORT

LAKE STATES FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

E. L. Demmon, Director

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University of Minnesota
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Annual Report

LAKE STATES FOREST EXPERIMENT STATION

1944

GENERAL

1944 marked the 21st birthday of the Lake States Station. It also marked the retirement from public service of Dr. Raphael Zon, the Station's director since its establishment on July 1, 1923. A world-renowned scientist, lecturer, and author, Dr. Zon's contributions to the progress of forestry in the Lake States region and in the Nation have been outstanding. Under his able direction, the Lake States Station has come of age, and is now widely recognized as a leading authority on many forestry problems.

Since Pearl Harbor, the Station's program has been oriented towards making maximum contributions to winning the war. Many regular projects have been curtailed or dropped entirely and major emphasis has gone into speeding the production of materials vitally needed for war purposes. Only minor attention has been given to maintenance of experiments and the preparation of reports to meet post-war needs.

The Station should be in a position to furnish the scientific information on which to base future forestry developments in the Lake States, a region with 45 percent of its area definitely better suited to timber growing than for any other purpose. If wisely managed, these forest lands can make a major contribution to the future economic development and well-being of this region.

EMERGENCY WAR PROJECTS

The Station has participated in two major projects closely related to prosecution of the war -- the Requirements and Supplies surveys for the Lake States and the Timber Production War Project in Minnesota. General supervision for the Timber Production War Project is vested in the Regional Forester, Milwaukee. In practice the surveys and action project have been closely dovetailed throughout the region.

Requirements and Supplies

The principal activities have been a monthly sampling survey of lumber production, a quarterly survey of lumber stocks, a quarterly report on factors affecting lumber production, and special projects when called for by the War Production Board. The Station has contributed a large share of the time of its regular Forest Survey and Economics personnel and occasionally men from other divisions to this war job.

A few points of more than current interest have come out of recent surveys:

1. Increasing importance of small mills

Closing down of several large sawmills during recent years and starting of several new small mills to work on war contracts has increased the importance of small-mill production. For example, in 1941 only one-third of Michigan's production was from small mills, whereas by 1943 the proportion was nearly half.

Closely connected with the growing importance of the small mill is the increasing number of sawmills which are combining the production of rough lumber with the manufacture of such secondary wood products as farm implements, crates, turned articles and furniture stock.

2. Cedar pole supplies

A critical shortage of northern white cedar poles was indicated by the following inventories from five Twin Cities pole concentration yards:

| <u>Year ending</u> | <u>Production</u> | <u>Inventory</u> |
|--------------------|-------------------|------------------|
| April 1 | | |
| 1942 | 175,000 | 280,000 |
| 1943 | 112,500 | 230,000 |
| 1944 | 35,000 | 30,000 |
| 1945 (est.) | 27,500 | 6,000 |

At the same time, a survey of producers in the Upper Peninsula of Michigan showed current production less than 5 percent of normal and inventories only 2 or 3 percent of normal. The main reason given for this slump was that neither producers nor distributors could operate at a profit at current prices.

3. Marketing practices - small sawmills

More than half the lumber produced in the Lake States in 1943 was sawed by small mills (one million feet or less annual cut). A survey of part of the 2,800 mills involved, disclosed that:

- (a) Ninety percent sell at least part of their hardwood lumber on grade, although less than half have qualified lumber graders at the mill.
- (b) Most of the graded lumber, at ceiling prices, brought an average return of \$56.36 (1st quarter 1944) as compared with pre-war mill-run prices of \$25 to \$35.
- (c) Most small mills are independently operated -- only one in ten has a financial tie-up with a large mill or concentration yard.
- (d) Two-thirds of the mills air-dry their lumber before shipping. One-third surface it. Fifteen percent saw small dimension stock (average price \$70.00).

(e) Market outlets were roughly as follows:

| | <u>Percent</u> |
|-------------------------------------|----------------|
| Furniture or flooring plants | 28 |
| War plants | 25 |
| Railroads (mostly ties) | 15 |
| Concentration or distribution yards | 14 |
| Wholesalers or commission men | 13 |
| Direct to farmers | <u>5</u> |
| | 100 |

4. Gasoline consumed by small sawmills

The following figures were obtained in a rough survey:

| <u>Operation</u> | <u>Gallons per 1,000 bd. ft.</u> | | |
|----------------------------------------------------------------------------------|----------------------------------|-------------|------------|
| | <u>Average</u> | <u>High</u> | <u>Low</u> |
| Sawing rough lumber | 5.5 | 8.0 | 3.0 |
| Sawing ties (30 ties per M) | 3.7 | 4.5 | 3.0 |
| Cutting fuelwood to stove length requires about 1/3 gallon per standard cord. | | | |

5. Efficiency of workers

In Michigan, declining output caused by necessity of substituting green or unwilling workers for men drafted or lost to other jobs is illustrated by the following data obtained at 14 sawmills:

| <u>Class of mill</u> | <u>Board feet per man-hour in mill</u> | | |
|-------------------------------|----------------------------------------|-------------|-----------------|
| | <u>1942</u> | <u>1943</u> | <u>(6 mos.)</u> |
| Small (100 to 999 M per year) | 7 mills | 164 | 159 |
| Medium (1,000 to 4,999 M) | 5 mills | 93 | 88 |
| Large (5,000 M +) | 2 mills | 61 | 58 |
| | | | 56 |

The difference between large and small mills is mainly due to differences in degree of processing.

At 19 mill and woods operations, efficiency has declined according to the following survey:

| <u>Job</u> | <u>Thousand board feet per man-day</u> | | |
|--------------------------|----------------------------------------|-------------|-----------------|
| | <u>1942</u> | <u>1943</u> | <u>(6 mos.)</u> |
| Head sawyer | 13.1 | 12.6 | 12.0 |
| Lumber piler | 7.0 | 6.5 | 6.0 |
| Log cutter | 3.3 | 3.1 | 2.8 |
| Truck driver on log haul | 5.6 | 5.0 | 4.7 |

6. Safety

In its contacts with the logging operators cooperating in the Requirements and Supplies surveys, the Station is laying special emphasis upon the need for greater safety precautions. Special attention was called to precautions needed in fire protection during cold weather. Also, safety suggestions were made for the use of power chain saws.

Timber Production War Project

The chief function of the Station has been to stimulate and correlate the activities of personnel on the National Forests, the State Forest Service, county forestry organizations, Soil Conservation Service, and county agents in Minnesota in carrying out the aim of the War Production Board to increase production of lumber and other forest materials urgently needed for war purposes.

An example of one type of work was recorded by a State Area Supervisor in western Minnesota who found a farmer cutting his immature stand of jack pine into pulpwood. He persuaded him to stop this cutting by selling him timber from an overmature stand of jack pine on State land.

Another activity of this project has been helping to obtain labor for sawmills and woods camps. Early in the fall, project foresters assisted the district managers of the U. S. Employment Service on a survey of sawmills to learn the manpower needs. Later an intensive drive was made to impress upon people the importance of timber production for the war and the urgent manpower requirements. Movies, talks, newspaper articles, and radio broadcasts were used.

Considerable assistance has been given to the Army in handling Prisoner of War camps in northern Minnesota.

Forestry personnel has been instrumental in obtaining used army trucks, trailers, tractors, and other items of equipment for use in the woods. They have also assisted in rationing of new equipment.

Draft deferments have been requested only in the most urgent cases.

FOREST SURVEY

Resource Reappraisal

A start was made in 1944 on a 10-year revision of Forest Survey statistics for the Lake States region (the original statistics were as of 1936). The outstanding facts so far disclosed are these:

1. The acreage of different forest types has not changed materially in the last 10 years. Increases in the deforested area have been offset largely by natural restocking and new plantings. There has been some further infiltration of balsam fir into aspen stands, forecasting an extension in the area of coniferous forests.

2. Acreage of mature saw timber, particularly in northern Wisconsin and the Upper Peninsula of Michigan, has shrunk, with corresponding increases in areas of second growth. The density of young stands has not improved as much as was anticipated because of extensive cutting in these stands and widespread pasturing of farm woods.
3. The volume of pine and northern hardwood saw timber is less than it was 10 years ago. The same is true of spruce pulpwood, cedar poles, tamarack mine timbers, and several other products. Some species have held their own and a few have increased in volume. Increases have been mainly in cordwood rather than in saw-timber sizes.
4. The rate of timber cutting, mainly because of the war, has been more rapid than was expected when the original survey was made. In Minnesota, for example, lumber production has increased 50 percent since 1939, and pulpwood 100 percent. There are some compensating features, however. Utilization has improved in general, cutting of merchantable trees for fuelwood has declined greatly, fire losses have been less than during the previous decade, and considerable land has been incorporated into public forests. Aggregate drain for the decade in Minnesota was not far different from forecasts.
5. Because of heavy cutting in young stands, the growth has not been as great as was forecast for the softwood types and the rough equilibrium between growth and drain has changed to overcutting.
6. General conclusions from the new reappraisal probably will not be greatly different from those originally drawn, namely:
 - (a) That the Lake States forests are growing but a fraction of the timber volume they are capable of yielding under good management.
 - (b) That adequate steps to reforest cut-over lands and protect young growth from fire will bring good results in the long run, but
 - (c) That prospects for increased yields in the near future are being lowered mainly by a continuation of poor cutting practices.

The general reappraisal which will be pushed to conclusion in 1945 will be followed by more localized studies, aimed to assist timber owners and operators in problems of post-war readjustment.

FOREST ECONOMICS

One objective of this project is to assist farmers and small loggers in marketing their forest products to best advantage. It is concerned with good utilization as well as with profits. Following are some specific accomplishments:

1. A mill-scale and time study was made at a small sawmill at Cass Lake, Minnesota to get information on overrun and cost of manufacturing box lumber from 8-foot aspen box bolts. The study showed that the higher costs of sawing small bolts (6 and 7 inches) are more than compensated by their higher overrun if the bolts are purchased on Scribner Dec. C. scale. This is not true, of course, when the wood is purchased by the cord. An interesting sidelight is that the current ceiling price for woods-run of bolts measured by log scale is considerably lower than the ceiling by cord measure.

2. A study of tie operations in southwestern Wisconsin indicated that it is more profitable to saw No. 3 short logs and the hearts of No. 2 logs into ties than into lumber. Not only are current tie prices better foot-for-foot than the No. 3 common lumber which most of these logs yield, but the amount of work and costs involved in production are less. The sides of the better tie logs, however, yield from 6 to 8 board feet of lumber of a quality worth careful handling.

3. A pocket-size slide rule for quick calculation of volume and growth of individual trees was developed and distributed among farm foresters for experimental use. One setting of the rule, using diameter and log height, gives gross tree volume. Another setting, for the number of rings in last inch of radius, gives annual growth. Further adaptations of the rule to International and Doyle scale, as well as cordwood volume, are being made.

4. Through membership on the Minnesota USDA War Board the Station cooperated in drafting recommendations for benefit payments to be given farmers for forest planting and other forestry practices for the year 1945. Restoration of the forestry items in an AAA program was urged.

FOREST MANAGEMENT

Forest fire research

Fire protection is a prerequisite to any type of forest management and is doubly essential during wartime. The fire record in the Lake States in recent years has been good, in part due to favorable weather conditions. The following statistics for the period, 1939-1943, cover only the areas protected by State fire organizations (18,800,000 acres in Minnesota; 13,200,000 acres in Wisconsin; 16,600,000 acres in Michigan; total 48,600,000 acres for region):

| Year | Number of fires | | | | Area burned (acres) | | | |
|------|-----------------|-------|-------|-------|---------------------|--------|--------|---------|
| | Minn. | Wisc. | Mich. | Total | Minn. | Wisc. | Mich. | Total |
| 1939 | 1,357 | 2,021 | 1,172 | 4,550 | 68,054 | 9,864 | 47,071 | 124,989 |
| 1940 | 996 | 1,622 | 899 | 3,517 | 73,173 | 11,534 | 17,388 | 102,095 |
| 1941 | 328 | 799 | 1,604 | 2,731 | 4,096 | 1,439 | 10,462 | 15,997 |
| 1942 | 598 | 823 | 807 | 2,228 | 34,394 | 3,104 | 14,905 | 52,403 |
| 1943 | 753 | 962 | 723 | 2,438 | 47,706 | 12,814 | 18,563 | 79,083 |
| Ave. | 806 | 1,245 | 1,041 | 3,093 | 45,485 | 7,751 | 21,678 | 74,913 |

During 1944, the Station's forest fire research effort has been confined almost wholly to cooperation with Forest Service regional office on problems of fire control and State cooperation. The Station's one man on fire research spent several months in the Central States and Lower Michigan, servicing fire danger stations, checking fire weather records, and serving on a board of review. More recently, he has been gathering data for a revision of the area and cost figures used as a basis for Clarke-McNary fire protection allotments.

Although considerable progress has been made in forest fire control in the Lake States during the past decade, innumerable opportunities remain to develop new and improved techniques. With the recent increase in Clarke-McNary cooperative fire funds, there is added justification for a more adequate research program. Much accumulated fire research data in the Station files await analysis; additional checks of the Region 9 fire danger meter should be made; and many other desirable fire research projects, described in a tentative program of fire research for this region drawn up recently, await only on funds and personnel.

Cutting studies in black spruce

Spruce pulpwood is of outstanding importance in the manufacture of pulp and paper for war needs. Substitute woods can be used in part to meet the demand, but the blending of a certain proportion of long-fibered spruce provides needed strength properties. Currently, almost half of the spruce used by Lake States pulp mills is imported from Canada, and the possibility of limitations on these imports is causing much concern. It is all the more important now that local spruce supplies have been depleted to the point where present pulpwood cutting rates cannot be maintained much longer. The region's 2 million acres of spruce swamp, together with a considerable amount of spruce on uplands, cannot contribute its share to the region's future pulpwood needs unless management and protection practices are materially improved. It is significant, therefore, that Station studies of black spruce management have progressed to the point where definite cutting recommendations can be made.

Light partial cuttings, where not over 30 percent of the volume is removed at one time, are recommended for well-stocked young or mature swamp spruce stands. This type of cutting results in maximum rate of growth and permits successive cuts at intervals of 10 to 20 years. By this method, total yields over a rotation can be increased 40 to 50 percent. Unfortunately, many stands are too overmature to be adapted to partial cuttings. In such cases, there is no alternative to clear cutting, and regeneration becomes a major silvicultural problem. At times spruce swamps are stocked with advance reproduction and care in logging is the only measure needed. In other cases exposing more ground surface by piling the slash will provide a suitable seedbed. Upland spruce reproduction comes in better where mineral soil is exposed.

Another phase of spruce management concerns the closer utilization of tops and smaller trees. Such utilization would (1) produce more wood from the same area, (2) salvage small trees that would otherwise die and be wasted, and (3) simplify slash disposal.

During the past several years various phases of spruce management have been reported on currently. In order to bring together this information in a more comprehensive publication, a manuscript on the cutting and regeneration of black spruce, both on uplands and in swamps, is planned.

Red pine management

The present forests of red pine in the Lake States are limited as to area (340,000 acres of natural stands and 450,000 acres planted), yet they are probably the most productive, acre for acre, of any forest type in the entire region. They are being heavily cut during the war. It would seem appropriate, therefore to round up existing research information on cutting practices that would lead to more constructive management of this valuable tree.

Early management of red pine was by the seed tree method. From 1904 to 1923, extensive areas were cut on the Chippewa National Forest in northern Minnesota, leaving 5 percent (later 10 percent) of the volume in seed trees. An appraisal of the results of these seed tree cuttings shows that the method has many shortcomings. However, it was a forward step and has paved the way for more intensive forestry practices.

During the past 20 years, with an expanding market for pulpwood, box bolts, mine timbers, piling, and small saw logs, opportunities for intensive management of "second-growth" stands have improved. Information is now being assembled on harvest cuttings under shelterwood and partial cutting method, and on better utilization of smaller trees through thinnings and improvement cuttings.

Augmenting pulpwood supplies by thinnings

The possibilities of meeting more of the heavy wartime pulpwood demand through commercial thinnings has been explored. Experiments to test the feasibility of thinning young jack pine were conducted in cooperation with the Wisconsin Conservation Department and the two national forests in Minnesota. In two cases where cost records have been kept, the returns to labor were 87 cents and 92 cents per hour, respectively.

The second commercial thinning in a 35-year-old jack pine stand on the Chippewa National Forest has brought out strikingly the increased growth that results from frequent light thinnings. The first thinnings in 1940 removed from 4 to 5 cords per acre from stands supporting 21 to 23 cords, and the second thinnings in 1944 removed another 4 to 5 cords. Growth during the 5-year period averaged 6.4 cords per acre per year on these thinned plots. In contrast, the unthinned area lost 5.7 cords per acre in the death of trees due to overcrowding, with a net growth of only 1.1 cords per acre for the 5-year period.

The important point is that over 9 cords of merchantable pulpwood were harvested during the first 35 years of the life of the stand through judicious thinning, and the remaining stand is in better growing condition than the unthinned one. If such practices were generally applied the domestic supply of pulpwood would be greatly increased.

Timber stand improvement

As a basis for post-war timber stand improvement work on the 14 million acres requiring such treatment in the Lake States, a field survey was made during 1944, sampling 300,000 acres treated during the previous 10 years. Some 128 treated areas on seven national forests, three state forests, one county forest, and one private holding were visited. Thinnings, liberation and improvement cuttings, and prunings in 12 timber types were examined. In addition, over a score of foresters who supervised CCC timber stand improvement work were interviewed to get their opinions of how future programs of this type might be improved. A report on the results of this study is in preparation.

Nursery and planting

Nursery and tree planting studies have been placed on a maintenance basis for the duration of the war. The only field project undertaken in 1944 was a survey of shelterbelt plantings in the Great Plains, one Station man

being assigned to the job, to work with a Washington Office representative. Some 950 belts were examined and data collected on survival and growth, and effect of soil factors, cultivation, insects, and diseases.

A manuscript on nursery practice for the Lake States region, to provide a sound technical basis for expansion in this field after the war, was begun, but later discontinued. Likewise, work on the revision of the manuscript, "Reforestation in the Lake States," was suspended.

The Kok-Saghyz Rubber Project

Since other wartime sources of rubber seemed more promising than kok-saghyz (Russian dandelion), the experimental program for growing this plant was discontinued on June 30, 1944. The Station's responsibility in connection with this project consisted of making studies of root production, overwinter survival, germination from fall versus spring sowing, effect of time of harvesting upon root and rubber yields; flower and seed production and seed yield under different types of treatment. In addition, the seed sowed in the spring of 1944 in Minnesota was vernalized and tested by the Station.

Experimental forests contribute forest products for the war

Timber cutting on three Experimental Forests has been maintained at a high level of production. In 1944, these experimental areas contributed some 4 million board feet of timber to the war in the form of various products, while continuing to serve as demonstrations of integrated forest management.

One of the objectives of the Upper Peninsula Experimental Forest near Dukes, Michigan, is the maintenance of a permanent local forest community. The workers in the vicinity of this forest are mostly farmers who normally derive part of their income outside their farms. In producing somewhat over 2 million board feet, 4,800 man-days of employment were provided, with a total income of about \$32,000. Out of the total of 70 employables in the local community, 51 received part-time employment on the forest. In all, 43 families were represented. The average income per worker was \$630, and the average per family \$750. Although in peacetime these amounts might be lower, such income represents a substantial part of the cash receipts of these farmers. Also, the effectiveness of these workers in getting out forest products for the war is obviously increased by the opportunity to live at home and work near by. Where it is necessary for them to find employment in logging camps at some distance from their homes, they are reluctant to "stick it out" and their total production is much less. This community offers an example of how forest and farm work in the northern Lake States might well be integrated in the post-war development period.

FOREST INFLUENCES

A report on the value of windbreaks in reducing fuel requirements was completed. This study shows that a single windbreak on the north of a farmstead reduces fuel requirements about 25 percent, as estimated by South Dakota farmers, the percentage increasing with higher wind velocities.

Another shelterbelt project approaching completion deals with the relative wind and evaporation reductions by identical north-south and east-west barriers in five latitudes.

The results of the lysimeter study at LaCrosse, Wisconsin with full discussion of the problems encountered, are being written up so that research men undertaking similar studies in the future may benefit through a full treatment of the experiences in this case.

COOPERATIVE FARM FORESTRY PROJECTS

Minnesota

(In cooperation with the Minnesota Agricultural Experiment Station)

Utilization of aspen for building construction

Nearly 17 million acres, or one-third of the total forest area of the Lake States, are now occupied by the aspen type. This has come in after the original forest, mostly white pine, was cut over and burned. Some of this type may eventually be replaced by conifers or by better quality hardwoods, but large volumes of aspen for lumber, pulpwood, and other uses will be available for many years. How best to utilize this species is a major problem in this region.

In 1944, a survey was made to determine the extent to which aspen lumber has been used in building construction and whether or not this material has proved satisfactory from the standpoint of durability and general utility. It was found that aspen has been used rather extensively in Minnesota in the construction of barns, granaries, chicken houses, homes, log houses and cabins, and in imitation log cabins. It is wisely used in the rough for sheathing and roof boards, also for studding, rafters, joists, building posts and girders, plates and even for shingles. It is manufactured into flooring, shiplap, and drop siding for exterior finish. One case was found where aspen lumber and dimension had been used in a barn constructed in 1916. The aspen studdings were decayed to a height of about two feet above the sill, but there was no evidence of decay in the aspen joists and the aspen material used in the upper part of the same barn. In general, aspen lumber was found to be entirely satisfactory when used in places where the decay hazard was not too great, including the lower parts of well ventilated barns.

Wisconsin

(In cooperation with the Wisconsin Agricultural Experiment Station)

An important question confronting farmers in the oak and hardwood sections in the southern part of the Lake States region is the comparative value of their woodland for timber growing vs. pasture purposes. Much of this land is on steep slopes, and the cooperative study in southwestern Wisconsin was confined to pastures and woodlands with slopes in excess of 15 percent gradient. These pastures and woodlands are contributing importantly to the war effort in their yields of meat, dairy products, and various timber and other forest materials.

Pasture Experiments.--Four-year records have been obtained for a series of six renovated (improved) pastures and six checks; also for an additional eight experimental areas which were put under fence in the spring of 1942. The forage utilization from the six pastures renovated in 1940 averaged 3,362 pounds per acre annually; the yield from the untreated bluegrass check areas for the same period was 1,448 pounds. Thus, improved pastures

out-yielded unimproved grasslands by a 2.3 to 1 ratio. Wooded pastures, those areas which are too much timbered to be classed as open land but which are too sparsely stocked with trees to meet the requirements for even a moderately productive forest -- provided 250 pounds, dry weight, of forage per acre per year. On this basis improved pastures were 13.4 times and unimproved, open bluegrass lands 5.8 times more productive than the so-called wooded pasture. The low forage yield for tree shaded bluegrass sod bears out previous observations by foresters and agronomists alike that a grazed woods is neither a good forest nor a satisfactory pasture.

Woodland Studies.--In 1944, work on the forestry aspects of the project included the following: (1) Completion of field work on an oak utilization study on two different logging operations, one 85 years in age and the other 95. Site index, stand volume per acre, log-grades, and radial growth by 10-year periods were determined. The investigation showed that timber values increase more rapidly, proportionately, than the volume of new wood and consequently that it pays to hold well formed trees until diameters of 16 inches d.b.h. or larger have been attained. The reason for this is that large trees yield more No. 1 and No. 2 logs than small saw-log trees, and hence return a higher value per thousand board feet. (2) Preparation of a series of growth and yield tables showing the yields of different products obtainable from oak stands in southwestern Wisconsin managed for timber production only. (3) Derivation of a method for determining site quality of oak forests especially applicable to under-stocked stands.

After the next season's field work, which will complete five years of study, the Wisconsin Agricultural Experiment Station and the Station will prepare a joint report on the possible use of the steep sloping lands of southwestern Wisconsin for timber growing or pasture purposes.

Michigan

(In cooperation with the Michigan Agricultural Experiment Station)

Agricultural veneer container industry

Veneer containers, including bushel baskets, berry baskets, and crates, are used extensively in marketing Michigan fruit and vegetables. The large market for such containers has stimulated development of basket factories in southern Michigan. These factories not only provide considerable employment and payrolls but are an important outlet for farm woodlot timber in this area.

The container supply was inadequate for the 1943 fruit and vegetable crop and considerable concern was felt over 1944 prospects. With the support of both the fruit growers and the container industry, an economic survey of the factors responsible for curtailed production was undertaken. The survey showed that very serious losses of fruit would occur if there were a bumper crop and that the container shortage would be serious even with an average crop. Stocks of all types of containers were low, principally because of a shortage of manpower caused in part by the low scale of wages. Some mills needed additional equipment. These problems were presented to the War Manpower Commission and the Office of Price Administration for appropriate action.

Other recommendations to meet the emergency included (a) increased imports of baskets and container veneer, (b) increased use of sawed boxes and paper boxes, (c) direct marketing in field crates, (d) re-use of baskets, (e) greater use of women laborers in the factories.

As a result of concerted efforts of fruit growers, basket makers, and several government agencies, the 1944 crop was marketed without serious loss.

ARTICLES PUBLISHED

Aldous, Clarence M.
and Shaler E. Aldous

The snowshoe hare - a serious enemy of forest plantations. Jour. For. 42(3): 88-94. Feb. 1944. illus.

Aldous, Shaler E.
and Gustav Swanson

Rabbit research at the University of Minnesota. Small Stock Magazine. April 1944.

Aldous, Shaler E.

A deer browse survey method. Jour. Mammalogy 25(2): 130-136. May 1944.

Aldous, Shaler E.

Winter habits of crows in Oklahoma. Jour. Wildlife Management 8(4): 290-295. Oct. 1944. illus.

Amidon, George B. and
Russell K. LeBarron

To what top diameter can spruce pulpwood be cut profitably? Pulp and Paper Magazine of Canada. Sept. 1944.

Bull, W. Ira and
M. B. Dickerman

How Michigan can supply wood for war industries. Mich. State Coll. Ex. Folder F-69. Feb. 1944.

Cunningham, R. N.

Past year's Lake States producer problems reviewed. Miss. Valley Lumberman. Jan. 28, 1944. pp. 9-10.

Cunningham, R. N.

Dr. Raphael Zon to retire Sept. 1 after 43 years active work with United States Forest Service. Miss. Valley Lumberman. Aug. 1, 1944. pp. 11-12.

Cunningham, R. N.

Research in wood supplies vital to Lake States pulp and paper industry. Paper Mill News. Sept. 23, 1944. pp. 108-110, 114.

Cunningham, R. N.

Impact of war on our forests. Land Policy Review (BAE) 7(3): 26-30. Fall 1944.

Cunningham, R. N.

Superior Forest offers big volumes pulpwood; timber cut increases. Miss. Valley Lumberman. Dec. 29, 1944. p. 30

Eyre, F. H. and Russell K. LeBarron Management of jack pine stands in the Lake States. USDA Tech. Bull. No. 863. Feb. 1944. 66 pp. illus.

Eyre, F. H. Good wages can be earned in thinning young jack pine for pulpwood. Wisc. Cons. Bull. Vol. 9, No. 7. July 1944. pp. 5-6. illus.

Gevorkiantz, S. R. Measuring stand normality. Jour. For. 42(7): 503-508. July 1944. illus.

Gevorkiantz, S. R. and Harold F. Scholz Determining site quality in under-stocked oak forests. Jour. For. 42(11): 808-811. Nov. 1944.

Gevorkiantz, S. R. and Paul Zehngraff More box lumber from small aspen bolts. Miss. Valley Lumberman. June 23, 1944. pp. 10-12. illus.

Johnson, Richard C. The outlook for agricultural veneer containers in southern Michigan. Econ. Note No. 20. May 1944. 11 pp. mimeo.

LeBarron, Russell K. Influence of controllable environmental conditions on regeneration of jack pine and black spruce. Jour. Agric. Research 68(3): 97-119. Feb. 1944.

Rudolf, Paul O. Post-war Gopher forest program urged -- $2\frac{1}{2}$ million acres to plant. St. Paul Pioneer Press. April 2, 1944.

Scholz, Harold F. Quality of side lumber from oak tie bolts in southern Wisconsin and Minnesota. Cross Tie Bulletin 25(10): 8-10. Oct. 1944.

Scholz, Harold F. Tie grades produced in southern Wisconsin. Cross Tie Bulletin 25(12): 8-12. Dec. 1944.

Zilgitt, W. M. Growth response in sugar maple following light selective cutting. Jour. For. 42(9): 680. Sept. 1944.

Zon, Raphael Fuller use of all land. Land Policy Review 7(3): 17-21. Fall 1944.

Technical Notes

215. Overrun of lumber from aspen bolts. April 1944.
216. A new trend in small sawmill operation. April 1944.
217. Disking reduces slash fire hazard in the jack pine type. April 1944.
218. Disking saves the topsoil in forest planting. April 1944.
219. Northern hardwoods can be cut selectively at short intervals. April 1944.
220. Additional volume of spruce pulpwood gained by utilizing to a $1\frac{1}{2}$ -inch top. April 1944.
221. Elimination of seasonal variation in lumber production - a hopeful trend. April 1944.
222. Does diameter growth response hold above d.b.h.? April 1944.
223. Gasoline requirements of small sawmills. April 1944.
224. Save shelterbelts and you save fuel. August 1944.
225. Quick field-calculator of volume and growth of trees. August 1944.